Organizational Change and Reference Dependent Preferences

Klaus M. Schmidt and Jonas von Wangenheim

EEA / ESEM Conference, Barcelona

August 28th, 2023

1. Introduction

Steel Industry in the Mid West:

- Geographically protected from competition for more than 100 years.
- Competitive shock in the early 1980s.
- Productivity increase of 100 percent within two years.
- Schmitz (2007): Made possible by organizational change.

1. Introduction

Steel Industry in the Mid West:

- Geographically protected from competition for more than 100 years.
- Competitive shock in the early 1980s.
- Productivity increase of 100 percent within two years.
- Schmitz (2007): Made possible by organizational change.

Why did it take so long? Why did it need a crisis?

1. Introduction

Steel Industry in the Mid West:

- Geographically protected from competition for more than 100 years.
- Competitive shock in the early 1980s.
- Productivity increase of 100 percent within two years.
- Schmitz (2007): Made possible by organizational change.

Why did it take so long? Why did it need a crisis?

Large and persistent differences in total factor productivity across firms:

- In the US, TFP of a firm at the 90th percentile is 90% higher than the TFP at the 10th percentile (Syverson (2004)).
- Growing evidence that this is due to differences in managerial practices (Bloom et al. 2014, 2017).

1. Introduction

Steel Industry in the Mid West:

- Geographically protected from competition for more than 100 years.
- Competitive shock in the early 1980s.
- Productivity increase of 100 percent within two years.
- Schmitz (2007): Made possible by organizational change.

Why did it take so long? Why did it need a crisis?

Large and persistent differences in total factor productivity across firms:

- In the US, TFP of a firm at the 90th percentile is 90% higher than the TFP at the 10th percentile (Syverson (2004)).
- Growing evidence that this is due to differences in managerial practices (Bloom et al. 2014, 2017).

Why don't all firms adapt best practices?

Intuition I

Workers resist change because it induces feelings of losses:

- Workers have reference-dependent preferences.
- Reference point is partly determined by status quo (and partly by rational expectations).
- Lower wages or higher effort as compared to reference point induces a psychological loss.
- In normal times workers demand a large wage increase for higher effort to compensate for psychological loss.
- This makes change expensive and slow.

Intuition II

In a crisis change becomes cheaper to implement:

- Workers have to make concessions to keep their firm in business.
- Wages have to fall and/or effort has to rise.
- Wage cuts and effort increases are **both** perceived as losses.
- Thus, the relative price of effort is reduced during a crisis. There is less resistance to change.

Intuition III

How expectation management works:

- Reference point is partly shaped by expectations.
- If workers believe that it is very likely that change will come, their reference point is closer to change. Thus, there is less feeling of a loss, and it becomes cheaper to implement change.
- A “determined” management committed to change can implement change at a lower cost.
- Owner of the firm will incentivize the manager to push change through.

Relation to the Literature

Many explanations for inefficiencies within firms:

- Informational asymmetries: Bolton and Dewatripont (2013).
- Conflicts of interest within the firm: Dewatripont and Roland (1994), Rajan and Zingales (2001), Dow and Perotti (2010).
- Complementarities: Milgrom and Roberts (1992), Brynjolfsson and Milgrom (2013).
- Learning, diffusion of information: Hall (2003).
- Behavioral biases: Hart and Moore (2008), Herweg and Schmidt (2015), Alesina and Passarelli (2017).

These theories can explain inefficiencies and resistance to change, but they do not explain the observed *patterns* of organizational change.

Outline of the Talk

Outline of the Presentation:

1. A Static Coasian Model of Organizational Change with Reference Dependent Preferences
2. A Simple Dynamic Model
3. The Role of Expectation Management (if time allows)

2. A Coasian Model with Reference Dependence

Two players negotiate organizational change:

- principal (firm owner, she)
- agent (workers/union, he)

The principal maximizes the profits of her firm:

$$\Pi = v(x, \theta) - w - C$$

where

x action ("effort") taken by workers, $x \in \mathbb{R}$, $c(x) = x$,

θ state of the world (the "state of technology"),

w wage paid to workers,

C is some fixed cost of production,

and $v(x, \theta)$ satisfies $v_x(\cdot) > 0$, $v_{xx}(\cdot) < 0$, $v_\theta(\cdot) > 0$, and $v_{x\theta}(\cdot) > 0$.

Workers' preferences

Workers are affected by **loss aversion**:

$$U = \underbrace{w - x}_{material\ utility} \underbrace{-\lambda[w^r - w]^+ - \lambda[x - x^r]^+}_{disutility\ from\ loss\ aversion}$$

where $[\cdot]^+ = \max\{\cdot, 0\}$ and $\lambda > 0$ measures the degree of loss aversion.

Reference point: (w^r, x^r) is a convex combination of the status quo (w_0, x_0) and the rational expectation (w^e, x^e):

$$\begin{aligned} w^r &= \alpha w_0 + (1 - \alpha) w^e \\ x^r &= \alpha x_0 + (1 - \alpha) x^e \end{aligned}$$

with $\alpha \in [0, 1]$.

Contracting

All actions are perfectly contractible.
No informational asymmetries or other contractual frictions.

Firm makes a take-it-or-leave-it offer.
If workers reject, the status quo contract remains in place which yields outside option utility

$$U_0 = w_0 - x_0$$

The firm's problem is

$$\max_{w,x}\{v(x,\theta) - w\}$$

subject to

$$U \; = \; w - x - \lambda[w^r - w]^+ - \lambda[x - x^r]^+ \; \geq \; U_0$$

Benchmark: No loss aversion

If $\lambda = 0$ the firm offers a contract that implements the **materially efficient** / **first-best** allocation $x = x^{ME}(\theta)$ which is characterized by

$$\frac{\partial v(x^{ME}, \theta)}{\partial x} = 1$$

and

$$w^{ME} = U_0 + x^{ME}(\theta).$$

$x^{ME}(\theta)$ and $w^{ME}(\theta)$ are increasing in θ.

Optimal contract with loss aversion:

Suppose the principal wants to increase x. The workers' participation constraint is

$$w - x - \lambda(x - \underbrace{(\alpha x_0 + (1-\alpha)x)}_{=x^r} \geq U_0.$$

Optimal contract with loss aversion:

Suppose the principal wants to increase x. The workers' participation constraint is

$$w - x - \lambda(x - \underbrace{(\alpha x_0 + (1-\alpha)x)}_{=x^r} \geq U_0.$$

This is equivalent to

$$w \geq x + \alpha\lambda(x - x_0) + U_0$$

The principal's problem is

$$\max_{x \geq x_0} \Pi = \max_{x \geq x_0} \{v(x,\theta) - [x + \alpha\lambda[x - x_0] + U_0]\} \ .$$

FOC:

$$\frac{\partial v(x,\theta)}{\partial x} \leq 1 + \alpha\lambda \quad \begin{cases} \text{with "<" if } x = x_0 \\ \text{with "=" if } x > x_0 \end{cases}$$

Optimal Contract

Proposition 1 (Inertia)

Suppose that the status quo is given by (w_0, x_0) *with* $x_0 \leq x^{ME}$*. Define* $\overline{x}(\theta)$ *implicitly by* $\frac{\partial v(\overline{x},\theta)}{\partial x} = 1 + \alpha\lambda$*. The principal offers a contract* (x^*, w^*) *to the workers that is given by*

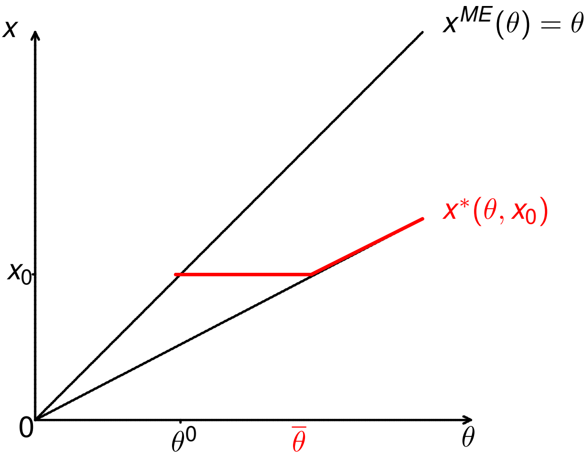
$$x^* = \begin{cases} x_0 & \text{if } x_0 \geq \overline{x}(\theta) \\ \overline{x}(\theta) & \text{if } x_0 < \overline{x}(\theta) \end{cases} \tag{1}$$

and

$$w^* = \begin{cases} w_0 & \text{if } x_0 > \overline{x}(\theta) \\ w_0 + (1+\alpha\lambda)[\overline{x}(\theta) - x_0] & \text{if } x_0 < \overline{x}(\theta). \end{cases} \tag{2}$$

Remarks

1. **Inertia:**
   - If θ increases there is some range in which the owner does not adjust x.
   - If $\theta > \overline{\theta}(x_0)$ the owner adjusts x, but the adjustment is too small as compared to the materially efficient allocation.
2. **Reference point:** The larger α, i.e. the more weight is put on the status quo in the formation of the reference point, the larger is the effect of loss aversion (more inertia). Similar for λ.
3. **Material vs. behavioral efficiency:** The principal implements strictly less change than materially efficient.
   But the solution is efficient in utility terms, i.e. if the loss aversion of workers is taken into account.



- There is inertia with respect to change.
- Increase in α or λ turns inertia line clockwise. $\rightarrow$ more inertia, less change
- The solution is not materially efficient, but behaviorally efficient.

3. The Effects of a Crisis

Crisis:

- increase in competition
- demand shock, input cost shock
- idiosyncratic shock, e.g. a large unexpected loss (loss of major client, “Dieselgate”, etc.)

The crisis reduces the firm’s profits. We model such a crisis as an increase of the parameter C.

Remark: For simplicity, a crisis does not affect productivity.

- if the cost shock is sufficiently large the firm will go bankrupt without workers’ concessions.
- Unemployment utility, normalized to zero, is the workers’ new outside option.

Consider a situation in which C has increased such that

$$\Pi = v(x_0, \theta) - w_0 - C \; < \; 0$$

- If workers reject the firm's take-it-or-leave-it offer the firm goes bankrupt and the workers receive zero utility.
- The workers' outside option has decreased to zero.
- The firm may implement lower wages and/or higher effort.

Consider a situation in which C has increased such that

$$\Pi = v(x_0, \theta) - w_0 - C \ < \ 0$$

- If workers reject the firm's take-it-or-leave-it offer the firm goes bankrupt and the workers receive zero utility.
- The workers' outside option has decreased to zero.
- The firm may implement lower wages and/or higher effort.
- Decreasing wages or increasing effort each come at a utility cost of $1 + \alpha\lambda$ for workers.
- Decreasing wages increases profits at rate 1.
- Increasing effort increases profits at rate $\frac{\partial v(x,\theta)}{\partial x} > 1$ (as long as $x < x^{ME}$).

Hence, the firm finds it more profitable to increase effort.

Optimal Contract in a Crisis

Proposition 2 (Effect of a crisis)

Suppose that the status quo contract (w_0, x_0) *satisfies* $x_0 \leq x^{ME}(\theta)$ *and*

$$v(x_0, \theta) - w_0 - C < 0.$$

Define $\hat{x}$ *implicitly by* $U(w_0, \hat{x}) = 0$*, and* $\overline{x}(\theta)$ *as in Proposition 1 by* $\frac{\partial v(\overline{x}(\theta), \theta)}{\partial x} = 1 + \alpha\lambda$*.*

1. *If* $\hat{x} \geq \overline{x}(\theta)$ *the firm offers a contract with* $x^* = \min\{\hat{x}, x^{ME}(\theta)\}$*.*
2. *If* $\hat{x} < \overline{x}(\theta)$ *the firm offers a contract with* $x^* = \overline{x}(\theta)$*.*

w^* *satisfies* $U(x^*, w^*) = 0$*, and workers accepts the offer.*

Remarks:

1. If the workers' rent is sufficiently large, the parties "jump" to the materially efficient allocation.
2. If the workers' rent is intermediate, the parties adjust x so as to avoid a wage reduction (but not more).
3. If the workers' rent is small (as compared to C) it does not suffice to save the firm.
4. Proposition shows that wages often do not fall in a crisis: Firm uses crisis to negotiate concessions on organizational change.

4. A Simple Dynamic Model

One-period model captures the main intuition for the effects of a crisis, but leaves several questions unanswered:

- The crisis has an effect only if workers enjoy a rent. Where does this rent come from?
- Reference points are not fixed but adjust over time. How does this change the optimal contract?
- Rational players anticipate that there may be a crisis. How do they prepare for it?

4. A Simple Dynamic Model

One-period model captures the main intuition for the effects of a crisis, but leaves several questions unanswered:

- The crisis has an effect only if workers enjoy a rent. Where does this rent come from?
- Reference points are not fixed but adjust over time. How does this change the optimal contract?
- Rational players anticipate that there may be a crisis. How do they prepare for it?

To answer these questions we develop a simple dynamic model.

The Dynamic Model

- Discrete time $t = 0, 1, ...$ with infinite horizon.
- Reference point adjusts after each period.
- θ_t grows deterministically.
- C_t is zero in all but one period.
- Probability $\mu > 0$ that $C_t = C_t^h > 0$ (given $C_s = 0 \ \forall s < t$).
- After observing the (θ_t, C_t), firm offers (x_t, w_t).
- If workers reject, (x_{t-1}, w_{t-1}) remains in place, but the firm can terminate the relationship.
- Both parties maximize discounted sum of expected utilities:

$$\begin{aligned}\Pi_t(x_t, w_t, \theta_t, C_t) &= \sum_{s=t}^{\infty} \delta^{s-t} \mathbb{E}_t[v(x_s, \theta_s) - w_s - C_s] \\ U_t(x_t, w_t | x_{t-1}, w_{t-1}) &= \sum_{s=t}^{\infty} \delta^{s-t} \mathbb{E}_t\left[w_s - x_s - \lambda\alpha[w_{s-1} - w_s]^+ - \lambda\alpha[x_s - x_{s-1}]^+\right].\end{aligned}$$

- Solution concept: Markov perfect equilibra

Step 1: Optimal Contract if there is no Crisis

- As θ increases, the firm wants to increase effort.
- The compensation for a permanent higher effort must account for:
  - Higher cost of effort each period.
  - One time behavioral adaptation cost.
- The compensation for the adaptation cost will be equally spread over all future periods:
  - The worker would not accept decreasing wages in the future.
  - The principal cannot commit to future increases.
- Workers accept an effort increase if and only if

$$(w_t - w_{t-1}) \geq (1 + (1-\delta)\alpha\lambda)(x_t - x_{t-1}).$$

- The firm's FOC is given by:

$$\frac{\partial v(x_t, \theta_t)}{\partial x_t} \leq 1 + (1-\delta)\alpha\lambda.$$

Proposition 3 (Inertia in the dynamic model)

Define $\overline{x}(\theta)$ implicitly by $\frac{\partial v(x,\theta)}{\partial x} = 1 + (1-\delta)\alpha\lambda$.
In period t the firm offers (x_t, w_t) given by

$$x_t^* = \begin{cases} x_{t-1} & \text{if } x_{t-1} > \overline{x}(\theta_t) \\ \overline{x}(\theta_t) & \text{if } x_{t-1} \leq \overline{x}(\theta_t) \end{cases} \tag{3}$$

and

$$w_t^* = \begin{cases} w_{t-1} & \text{if } x_{t-1} > \overline{x}(\theta_t) \\ w_{t-1} + \big(1 + (1-\delta)\alpha\lambda\big)[\overline{x}(\theta_t) - x_{t-1}] & \text{if } x_{t-1} \leq \overline{x}(\theta_t). \end{cases} \tag{4}$$

Remarks

- Proposition 3 parallels Proposition 1, but the wage increase is spread out evenly over time.
- Effort and wages weakly increase in every period.
- The solution is behaviorally (but not materially) efficient.
- A permanent effort increase of size Δx leads to permanent wage increase of $[1 + (1 - \delta)\alpha\lambda]\Delta x$.
- If effort increases in period t, workers suffer a utility loss in t, but enjoy a **quasi-rent** in all future periods.
- Firm's expected profit is given by

$$\Pi_t^* = \sum_{s=t}^{\infty} \delta^{s-t} \big(v(x_s^*, \theta_s) - w_s^* \big)$$

- Workers' expected utility is given by

$$U_t^* = U_0 + \underbrace{\alpha\lambda(x_{t-1} - x_0)}_{\text{expected value of quasi-rent}}$$

Step 2: Optimal Contract if Crisis is not anticipated

Suppose the crisis hits, i.e. $C_t = C_t^h$.

Assumption 1

The firm can survive the crisis only if the workers make concessions, i.e.

$$\Pi_t^* < C_t^h.$$

This is the most interesting case that we focus on.

In the crisis the outside option of the workers is no longer the contract in place but the utility of unemployment (normalized to 0).

As in static case, the firm uses lower outside option to increase effort.

Proposition 4 (Effects of an unanticipated crisis)

Suppose that Assumption 1 holds and there is a crisis in period t. Define $\hat{x}$ by $U_t(w_{t-1}, \hat{x}) = 0$, and $\overline{x}(\theta)$ by $\frac{\partial v(\overline{x}(\theta),\theta)}{\partial x} = 1 + (1-\delta)\alpha\lambda$.

- *If $\hat{x} \geq \overline{x}(\theta)$ the firm offers a contract with $x^* = \min\{\hat{x}, x^{ME}(\theta)\}$.*
- *If $\hat{x} < \overline{x}(\theta)$ the firm offers a contract with $x^* = \overline{x}(\theta)$.*

The offered wage w^* satisfies $U(x^*, w^*) = 0$, and the union accepts the offer.

Long-term dynamics

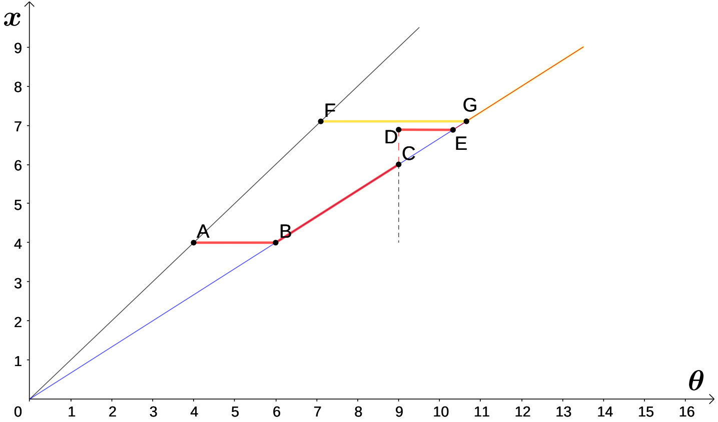


Figure: Firms created at A and F, cost shock at $\theta = 9$.

- Persistent productivity differences that narrow discontinuously in times of a crisis.
- Firms that are older pay higher wages.

Step 3: The Optimal Contract with Rational Expectations

Two additional effects:

1. Workers anticipate that they get compensation for behavioral cost only until crisis hits.
   - Their de-facto discount rate is $\delta(1-\mu)$.
   - They demand higher per-period compensation.

   Necessary compensation for an effort increase:

$$(w_t - w_{t-1}) \geq (1 + (1 - \delta(1-\mu))\alpha\lambda)(x_t - x_{t-1}).$$

Step 3: The Optimal Contract with Rational Expectations

Two additional effects:

1. Workers anticipate that they get compensation for behavioral cost only until crisis hits.
   - Their de-facto discount rate is $\delta(1-\mu)$.
   - They demand higher per-period compensation.

   Necessary compensation for an effort increase:

   $$(w_t - w_{t-1}) \geq (1 + (1 - \delta(1-\mu))\alpha\lambda)(x_t - x_{t-1}).$$

2. The firm delays change, because it anticipates that change can be implemented more cheaply in a crisis. (Alternatively: firm delays change because it anticipates bankruptcy in crisis.) The region of inertia widens.

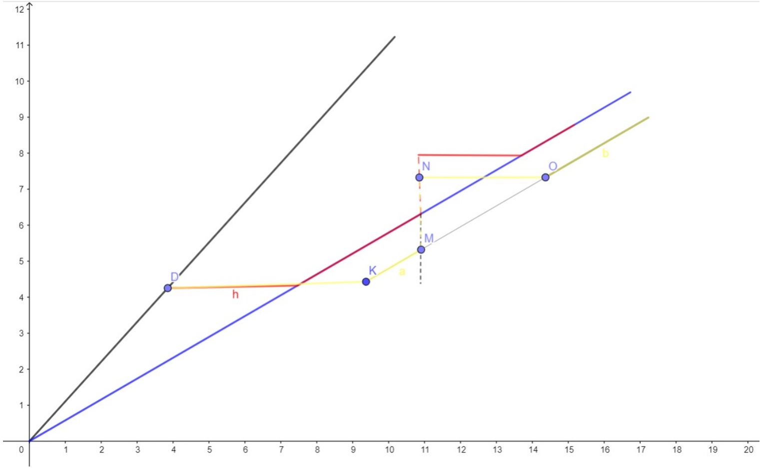


Figure: red: crisis unanticipated, yellow: crisis anticipated

- Intuition: yellow line is closer to (behaviorally) efficient blue line.
- A crisis benefits the firm because it can expropriate quasi-rents.
- Ex ante it does not, as it has to pay higher wages beforehand.

5. Expecation Management

Managerial effort and probabilistic change:

1. Change is successful with probability p (if not opposed by workers).
2. Change is discrete: If there is change, the principal's profit increases by Δv and the cost to workers is Δx.
3. Manager: Probability p is chosen by the top manager at cost $c(p) = \frac{c}{2}p^2$; p is non-contractible.
4. The manager is risk neutral and wealth constrained. For simplicity he is not affected by loss aversion.
5. Principal has to
   - incentivize manager to choose p by offering a bonus b if change is successful,
   - negotiate with workers to accept change for a fixed wage increase Δw.
6. If workers believe that change is successful with probability p their reference point is $x^r = \alpha x_0 + (1-\alpha)(x_0 + p\Delta x)$.

Lemma 1

With probabilistic change the principal has to pay to workers:

$$w_0 + \Delta w = x_0 + p(1+\lambda)\Delta x - p^2(1-\alpha)\lambda\Delta x \ + \underline{U}\ .$$

The wage increase Δw is concave in the probability of change p. It decreases in p iff

$$\frac{1+\lambda}{\lambda(1-\alpha)} < 2p.$$

Two effects:

1. An increase in p increases the expected cost of effort (linear effect)
2. An increase in p shifts the reference point upwards, so workers suffer less from loss aversion

Key insight: Implementing change becomes (relatively or even absolutely) less expensive for large p.

Optimization of the Principal

$$\max_{b,w} E\Pi = p(v + \Delta v - b) + (1-p)v - w$$

subject to

$$w = x_0 + p(1+\lambda)\Delta x - p^2(1-\alpha)\lambda\Delta x \; + \underline{U}$$

$$p \in \arg\max\{pb - \frac{c}{2}p^2\}, \;\; p \geq 0$$

Proposition 5

(a) *If $c < (1-\alpha)\lambda\Delta x$ the principal's problem is convex. She implements a corner solution $p \in \{0,1\}$, with $p = 1$ if and only if $\Delta v \geq (1+\alpha\lambda)\Delta x + c$.*

(b) *If $c > (1-\alpha)\lambda\Delta x$ the principal's problem is concave. She implements $p > 0$ if $\Delta v > (1+\lambda)\Delta x$, in which case p satisfies*

$$p = \min\left\{\frac{\Delta v - (1+\lambda)\Delta x}{2[c - (1-\alpha)\lambda\Delta x]}, 1\right\} \tag{5}$$

Expectation Management - Results

1. If λ and $(1-\alpha)$ are sufficiently large, a corner solution is optimal. The principal either induces the manager to implement change with probability one, or she implements no change at all.
2. Even if an interior solution is optimal, an increase of $(1-\alpha)$ increases the probability of change.
3. **Intuition:** It becomes cheaper to implement change, if workers are convinced that the change is going to take place with a high probability. The contract with the manager is a commitment of the principal that affects the workers' expectations.

Conclusions

We have introduced a tracktable model of reference-dependent preferences that is able to explain

- inertia in organizations
- drastic organisational change in a crisis
- persistent productivity differences across firms
- the importance of expectations management

The key force is an asymmetry in workers' preferences with respect to wage raises in normal times and wage cuts in a crisis.

Thank you for your attention!